

THE USE OF INFORMATION COMMUNICATION TECHNOLOGY IN TEACHING BASIC MATHEMATICS IN ABUJA MUNICIPAL AREA COUNCIL, FEDERAL CAPITAL TERRITORY

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Abstract

This study investigated the use of Information and Communication Technology (ICT) in the Teaching of Basic Mathematics in Junior Secondary Schools in Municipal Council Area of Federal Capital Territory, Abuja. The study adopted a survey design. A sample size of 180 was used. The mathematics teachers were randomly selected from secondary schools in this area. This sample represents the entire population under study. The researcher employed a structured 26 items questionnaire to collect data from the respondents. The questionnaire utilized a four-point rating scale with responses including Strongly Agreed, Agreed, Disagreed and Strongly Disagreed. The data collected were analysed with descriptive statistic of frequency counts and percentages. From the findings, mathematics teachers were enthusiastic about the application of ICT in mathematics teaching but only few were able to incorporate it. Again the most common ICT applications used by the few teachers who are already

making effort to integrate ICT into their teaching include: word processing packages and spreadsheet. The barriers identified were: lack of technical skills, poor electricity power supply in schools and lack of mathematics laboratories with ICT facilities. From the findings, the following recommendations were made: mathematics teachers should be encouraged to embrace the new method of teaching - use of ICT, in-service training for mathematics teachers; seminars and conferences should be organized by experts for mathematics teachers on ICT usage in teaching. State government should make frantic efforts to provide all the necessary facilities and equipment for the proper ICT usage in teaching mathematics in secondary school.

Keywords: ICT, Mathematics, Teachers, Teaching.

Introduction

The foundation of most science- related courses is commonly attributed to mathematics, which serves as the

cornerstone of technological progress. Recognizing its pivotal role, the Nigerian federal government, as outlined in the National Policy on Education (NPE, 2014), mandates the compulsory study of mathematics at all levels including tertiary education. In response, governmental efforts are earnestly directed towards providing high-quality mathematics education. Despite previous endeavours by various stakeholders to enhance mathematics teaching and learning, students' performance in external examination remain subpar, consequently, the Federal Government of Nigeria is contemplating the necessity of incorporating information and communication technology (ICT) in the instruction of mathematics.

A noteworthy initiative involved the introduction ICT in teaching and learning at basic school levels. According to Zarani (2019), technology is crucial for improving the teaching and understanding of mathematics; positively influencing the way mathematical concepts are taught.

Leah (2018) asserts that ICT offers benefits such as fostering collaboration among students, that the benefits of ICT promotes greater collaboration among students, encouraging communication, sharing of knowledge, providing rapid and accurate feedbacks, and promoting positive motivation. Additionally, it enables students to focus on strategies and interpretation rather than getting bogged down by tedious computational calculations. ICT aligns with constructivist pedagogy, allowing students to use technology to explore and grasp mathematical concepts. Further support for ICT integration comes from Shabani, Okebukola and Obanya, (2011), Otuka (2019) and Chong (2016) who

emphasize that technology enhances higher-order thinking and improves problem-solving strategies. This perspective resonates with the recommendations of the Mathematics Association of Nigeria (MAN) following its 2015 national conference. The implication is that students would increasingly employ technology for problem solving, moving away from manual methods. The successful implementation of this shift depends largely on teachers, who play a crucial role in interpreting and applying the policy in the classroom. Consistent with the adage that “no nation can rise above the standard of her teachers”. Salman and Adeniyi (2012) argue that teachers determine the success of failure of the teaching and learning process.

In agreement with this viewpoint, Salman and Adeniyi (2012), emphasizes that the teacher is key to a child's success both within and outside the school learning environment. Students, guided by thoughtful use of technology, enhance their reading, writing, speaking, listening and language skills. They purposefully conduct online searches to efficiently acquire useful information, integrating technological and offline learning experiences (Leah, 2018).

NPE, (2014) places emphasis on acquisition of skill, being creative and having the attitude of enquiry and problem solving. It also aimed at the development of ability and willingness in the students in carrying out experiments using various mathematical theories and operations. In addition to the reform to meet the demands of modern society, the policy emphasized the ICT for teaching mathematics.

Statement of the Problem

It is noteworthy that despite significant efforts from various stakeholders to improve teaching and learning of mathematics, students' performance in external examination has remained unsatisfactory. This is evident in the consistently poor performance of students in mathematics at the secondary school level. Several studies conducted by many authors on the poor performance of secondary school students, especially in the Senior Secondary School Certificate Examination (SSCE), revealed that failure rates in mathematics have been dramatically high. There is consistency in failure of students in mathematics of West African Examination Council (WAEC) which is evident in their performance as seen in May\ June result of 2008- 34.52%, 2009- 38.2%, 2010- 41.73%, 2014- 31.28%, 2015- 36% and 2016 – 38.7% credit pass. The last SSCE result of 2017 as announced by the Chief Examiner Officer of WAEC was 26.01% credit pass in English and Mathematics in Nov \ Dec. The Chief Examiner's report of the West African Examination Council has revealed the poor performance of senior secondary students in external examination as being appalling especially in geometry where the students found it difficult to draw correct figures (Nweke, Musa & Iji, 2019).

Numerous research efforts have sought to explain the persistent mass failure in Mathematics among students. Reasons identified include Poorly-resourced school; large class; a curriculum hardly relevant to the daily lives of students; a lack of qualified teachers; and inadequate teacher education programme" Nweke, (2018). While some studies propose solutions to the problem, such as a shift to student-centred and participatory teaching and learning, these recommendations often overlook teachers'

perception of ICT usage in Mathematics teaching at the secondary school level. For instance, the National Policy on Education (NPE, 2014) suggests that teachers should incorporate practical problems at the beginning of each lesson to foster analytical thinking and encourage the use of calculators and computer (ICT) to solve and investigate real- life situations"

In light of the policy's emphasis on a new approach to teaching and learning of mathematics, which requires commitment from both teachers and students, it is observed that teachers interpreting the policy often display passivity in the use of ICT in the classroom. This study aims to explore the extent of ICT usage in teaching and learning of mathematics in basic schools. While some schools especially private ones in FCT, have invested significantly in computer procurement and the establishment of computer laboratories, doubts remain about whether these resources are effectively utilized by teachers in their instructions. Consequently, the study addresses the question of whether there is need for mathematics teachers to be trained on how to effectively integrate ICT into their daily teaching routines as suggested by Douglas, (2015), Otuka, (2015).

The investigation stems from the concern about the persistent poor performance of students in mathematics, despite the proven to be effectiveness of various instructional strategies. This study seeks to identify other causes of this poor achievement in mathematics, specifically focusing on the use of ICT in teaching basic mathematics in Municipal Area Council of FCT, Abuja, Nigeria.

Objectives of the Study

Therefore, this study specifically sought to find out:

- 1) The use of ICT in teaching basic mathematics in FCT
- 2) The most common application packages in ICT used by mathematics teachers in basic schools.
- 3) Challenges to ICT usage by the mathematics teacher in basic schools.

Research Questions

The researcher formulated the following research questions to guide the study:

- 1) What are the needs of ICT usage in teaching basic school mathematics?
- 2) What are the most common application packages in ICT used by mathematics teachers in basic school?
- 3) What are the challenges to ICT usage to mathematics teachers in basic schools?

Literature Review

The incorporation of Information and Communication Technology (ICT) into the teaching and learning of mathematics remains unfamiliar to many, including some in school is still sounding strange to many, including some mathematics teachers. The reason for this unfamiliarity vary, ranging from a lack of ICT training during their teacher education to a lack of knowledge about ICT applications suitable for classroom situation. Notable example of ICT applications used in classroom include, portable, graphic calculators, computerized graphing, specialized software, programmable tools, drill/practice tutorials, interactive activities and computer in

general. Research has consistently demonstrated that these applications significantly enhance mathematics teaching and learning. For instance, students can utilize portable devices, aided by databases and spreadsheets, to gather and manipulate data for numerical work (Yeni, 2015). The use of portable devices also allows for fieldwork in addition to traditional classroom activities. Studies by Clement, (2000), Hennessy, (2000), & Hennessy, Fung & Scanlon (2000, have shown that the incorporation of calculators (especially graphic ones) and computerized graphing expedites was observed that using calculators (graphic) and computerized graphing expedites graphing processes, making it easier for individuals to analyze and illustrate data relationships.

Moreover, specialist software like computer like Computer Algebra System (CAS) Dynamic Geometry System (DGS) and mathematics curriculum software has been found to enhance students' skill and understanding in algebra, these tools enable students to manipulate and measure shapes, leading to a higher level of learning (Hennessy, Clement Fung & Scanlon 2000). Another noteworthy application is programmable toys or floor robots, which represents an early use of ICT in Mathematics. When controlled by programming software. These toys have demonstrated significant positive impacts on mathematics education (British Education Communications and Technology Agency (BECTA), 2003). Additionally, Logo, a programming language, has been reported to help students develop problem-solving skills, improves their thinking abilities, especially in mathematics, and grasp mathematical concepts (Clement, 2000).

Several studies have been conducted on the challenges to the use of ICT and mathematics teaching' in secondary schools. As already stated earlier, Anyonge (2017) identified seven factors to be responsible for this. These include:

- 1) The age of the teacher
- 2) Inaccessibility of computer during lesson
- 3) Inadequate time on the timetable for the use of ICT in the classroom
- 4) Lack of technical know-how especially if the software is in use
- 5) Low confidence among teachers during classroom instruction with ICT.
- 6) Lack of effective training
- 7) Lack of access to resources

Similarly, Snoeyink, and Ertmer (2002), Otuka, (2015), identified several barriers to the integration of ICT in Mathematics teaching: These barriers include a lack of computers, insufficient access to quality software, time constraints, technical issues, teachers' attitude (perception) towards computers, inadequate funding, low teacher confidence, resistance to change, insufficient administrative support, shortage of teacher skills, scheduling difficulties, limited training opportunities, and a lack of vision on how to integrate ICT in instruction.

Moreover, the low competencies and limited access to ICT facilities by both mathematics teachers and students stand out as primary barriers, following lack of electricity power supply. Additionally, factors such as a lack of maintenance culture and theft in society contribute to hindrances in utilizing ICT for Mathematics teaching and learning. Addressing, these challenges is crucial for

facilitating the effective use of ICT by mathematics teachers in secondary school education, which is the focus of this study.

Despite the policy advocating for the use of ICT IN - ICT being used in secondary school mathematics learning, there are indications that computers are not widely used in Nigerian secondary schools. To successfully integrate ICT into the mathematics curriculum, teachers must have a clear understanding of available software packages for day- to- day teaching (Chong, 2016).

A study by Forgasz and Prince, (2002) revealed that 61% of the respondents (teachers) used spreadsheets, 45% used processing and 30% employed internet browsers. Other software included Geometer's sketchpads, (19%), CD ROMs accompanying mathematics textbooks, (19%), Graphmatica (18%), mathematics blaster (14%), and other mathematics – specific software (8%). Beyond the lack of knowledge about available software packages, the study underscores the importance of methodical knowledge on how to use this software effectively in mathematics teaching at the secondary school's level. Furthermore, Anyonge, (2017) identified seven barriers to the use of ICT in mathematics lessons, including a lack of teacher confidence during integration (21.2% responses), limited access to resources (20.8%), insufficient time for integration (16.4%), inadequate training (15.0%), technical problems during software use (13.3%), limited personal access during lesson preparation (14.9%), and the age of the teacher (1.8%). Addressing these barrier is essential to promote the successful integration of ICT into mathematics teaching.

Methods

This study utilized a survey research design to investigate the usage of Information and Communication Territory (ICT) by mathematics teachers in teaching and learning basic school mathematics in FCT, Abuja. The choice of this design was deemed suitable as it aimed to gather the opinions of mathematics teachers regarding the due to the fact that it was meant to collect opinions of Mathematics teachers on ICT usage in the teaching and learning of basic school Mathematics. According to Ozofo (2012), a survey design involved “a method of gathering information from a sample of individuals”. With this sample representing the entire population under study. The study specifically conducted in the Municipal Council Area of FCT, Abuja was conducted in Municipal Council Area, FCT, Abuja.

For the research, a random sample of 180 secondary schools mathematics teachers was selected to participate. The researcher

employed a structured 26- item questionnaire to collect data from the respondents. The questionnaire utilized a four point rating scale with responses including Strongly Agreed, Agreed, Disagreed and Strongly Disagreed, as outlined by Emaiku (2015). To ensure the validity of the instrument, experts in Mathematics Education and Measurement & Evaluation from the University of Abuja were involved in its validation. The reliability of the instrument, measured by internal consistency, was found to be 0.87. Subsequently, the collected data underwent analysis using frequency and percentages. This methodology allowed for examination and presentation of findings, providing insights into mathematics teachers’ perspectives and practices regarding the use of ICT in teaching and learning basic school mathematics.

Results

Table 1: Frequency Counts and Percentages of the Response of Mathematics Teachers’ on ICT

S/N	Items	Response			
		SA	A	D	SD
1	I fully use ICT in my teaching instruction	28(15.6%)	31(17.2%)	76(42.2%)	45(25.0%)
2	I use ICT in my specific units of instruction	40 22.0%)	58(32.2%)	51(28.3%)	31(17.2%)
3	I frequently use ICT with the students	42(23.3%)	39(21.7%)	61(33.9%)	38(21.1%)
4	I have not used ICT before in my teaching	48(26.7%)	41(22.8%)	56(31.1%)	35(19.4%)
Total		N=180			

From table 1 above, the percentage response of those who agreed to item 1 is 32.8% which is very low compared to the percentage response of those who disagreed 67.2%. This indicates that ICT has not been fully integrated into Mathematics instructions in secondary school. The situation is quite different in item 2 with percentage response of agreed as 54.4%, where those who have made attempt of integrating ICT into Mathematics instruction, have gone to the extent of including it into the specific instructional

units. Furthermore, item 3 shows that Mathematics teachers do not use ICT frequently with the students. The percentage response is an indication of this. The last item, however, shows that Mathematics teachers have used ICT but not to a great extent due to certain barriers. On the whole, one could conclude that though ICT has not been fully integrated by mathematics teachers, efforts are being made by them to embrace the change. This implies that they have open mind towards ICT usage in Mathematics teaching in secondary schools.

Table 2: Frequency Counts and Percentages of Responses of Mathematics Teachers on ICT Packages used by Mathematics teachers

S/N	Items	Response			
	As a Mathematics teacher, I have used the following in my teaching:	SA	A	D	SD
1	Word processing packages	40(22.2%)	58(32.2%)	51(28.3%)	31(17.2%)
2	Portable	26(14.4%)	23(12.8%)	54(30.0%)	77(42.8%)
3	Graphic calculator	56(31.1%)	66(36.7%)	34(18.9%)	24(13.3%)
4	Spreadsheet	48(26.7%)	41(22.8%)	56(31.1%)	35(19.4%)
5	Simulation programmes	23(12.8%)	32(17.8%)	58(32.2%)	67(37.2%)
6	Drill/practice tutorials	58(32.2%)	49(27.2%)	40(22.2%)	33(18.3%)
7	Internet activity	42(23.3%)	39(21.7%)	61(33.9%)	38(21.1%)
8	Graphical applications	47(26.1%)	63(35.0%)	39(21.2%)	31(17.2%)
9	Databases	24(13.3%)	53(29.4%)	64(35.6%)	39(21.7%)
10	Flash presentations	28(15.6%)	31(17.2%)	76(42.2%)	45(25.0%)
11	Desktop publishing	37(20.6%)	41(22.8%)	59(32.8%)	43(23.8%)
Total N=180					

In table 2 above, teachers expressed their level of usage of most common applications for Mathematics instruction. Such applications like word processing (item 1) had 54.4% in agreement while 45.6% disagreed on the use of word processing package in teaching mathematics. Graphic calculator (item 3), drill/practice tutorials (item 6) and graphical applications (item 8) were the most commonly used by the few Mathematics teachers who attempted integrating ICT into teaching of

Mathematics. This is evidenced by the percentage score of those teachers who agreed to the usage of all these items. The table 2 also indicates that every other application was not frequently used by the teachers in their Mathematics instruction. This indicates that most of the applications for Mathematics instruction are not frequently used by the teachers. The response also indicates lack of knowledge of such applications.

Table 3: Frequency Counts and Percentages of Mathematics Teachers' Response on the Challenges to ICT Usage in the Classroom.

S/N	Items	Response			
	As a Mathematics teacher, I face the following barriers in using ICT in my teaching:	SA	A	D	SD
1	Lack of Available computer software	60(33.3%)	46(25.6%)	47(26.1%)	27(15.2%)
2	Inadequate time in the school timetable for ICT usage	61(33.9%)	45(25.0%)	31(17.2%)	43(23.9%)
3	Lack of enough technical know-how for ICT projects	68(37.8%)	66(36.7%)	43(23.95)	3(1.67%)
4	Lack of training for teachers on ICT usage	70(39.4%)	42(23.3%)	24(13.3%)	44(24.4%)
5	Poor knowledge of how to use ICT to improve curriculum	57(31.75)	62(34.4%)	41(22.8%)	20(11.1%)
6	Lack of auxiliary teachers or substitutes when teachers go for training	58(32.2%)	49(27.8%)	40(21.7%)	33(18.3%)
7	Inaccessibility of necessary technology by the students at home	42(23.3%)	39(21.7%)	61(33.9%)	38(21.1%)

8	Inaccessibility of necessary technology by the teachers at home	47(26.1%)	63(35.0%)	39(21.7%)	31(17.2%)
9	Lack of electricity power supply in schools	78(43.3%)	67(37.2%)	21(11.7%)	14(7.8%)
10	Lack of Mathematics laboratories with ICT facilities	78(43.3%)	55(30.6%)	32(17.8%)	15(8.3%)
11	Lack of maintenance due to bureaucracies	59(32.8%)	43(23.9%)	37(20.6%)	41(22.8%)

In Table 3 above, all the 11 items amounted to the noticeable challenges to ICT usage in Mathematics instruction. The percentage scores indicate that the chief barriers include: Lack of enough technical know-how for ICT projects, lack of electricity power supply in schools and lack of Mathematics laboratories with ICT facilities.

Discussion of Findings

The study investigated the use of Information and Communication Technology (ICT) in the Teaching of Basic Mathematics in Junior Secondary Schools in Municipal Council Area of Federal Capital Territory, Abuja. The findings of this study showed that ICT application has consistently enhance mathematics teaching and learning. For instance, students can utilize portable devices, aided by databases and spreadsheets, to gather and manipulate data for numerical work. This result is in line with the findings of Forgasz and Prince, (2002) whose study showed the importance of

The percentage score is a serious overall indication that ICT integration into Mathematics instruction in secondary school is facing a lot of challenges and setbacks. These barriers account for the Mathematics teachers ill-feeling and rigidity to the change brought in by ICT.

methodical knowledge on how to use this software effectively in mathematics teaching at the secondary schools level. The findings of this study also revealed that the use of portable devices also allows for fieldwork in addition to traditional classroom activities. This is in agreement with Clement, (2000), Hennessy, (2000) and Hennessy, Fung & Scanlon (2000) whose studies have shown that the incorporation of calculators (especially graphic ones) and computerized graphing expedites was observed that using calculators (graphic) and computerized graphing expedites graphing processes,

making it easier for individuals to analyzed and illustrate data relationships.

The findings of the study identified several barriers to the integration of ICT in Mathematics teaching. This result is in line with the findings of Anyonge, (2017) who identified seven barriers to the use of ICT in mathematics lessons, including a lack of teacher confidence during integration (21.2% responses), limited access to resources (20.8%), insufficient time for integration (16.4%), inadequate training (15.0%), technical problems during software use (13.3%), limited personal access during lesson preparation (14.9%), and the age of the teacher (1.8%). Addressing these barrier is essential to promote the successful integration of ICT into mathematics teaching.

Conclusion

The promotion of Information Communication Technology (ICT) integration in basic school Mathematics teaching within Nigeria, particularly in FCT, Abuja, has garnered widespread support and advocacy. Various strategies have been employed to actualize this objective, recognizing that teachers serves as the primary agents of curriculum implementation. However, despite these efforts this study reveals that the full integration of ICT into mathematics

instruction in basic school in FCT, Abuja, is yet to be achieved. Despite this, there is a positive inclination among mathematics teachers towards embracing ICT, as demonstrated by the readiness and open-mindedness displayed by those who have access to ICT. These teachers have taken steps to incorporate ICT into specific instructional units.

Moreover, the study identifies a significant gap in the awareness and utilization of various applications for mathematics teaching among teachers. Many educators remain unfamiliar with known applications, leading to apathy and a lack of confidence when considering ICT integration. This lack of awareness is evident in the surprise expressed by teachers when confronted with unfamiliar applications recommended for mathematics instruction.

Lastly, the study uncovers multiple challenges hindering the effective use of ICT in mathematics teaching. These challenges encompass the scarcity of available computer software, insufficient time allocated in the school timetable for ICT usage, a lack of teacher training on ICT, poor understanding of how to enhance the curriculum using ICT, a shortage of of how to use ICT to improve curriculum, lack of auxiliary teachers or substitutes during teachers training and limited accessibility of necessary technology for students. The most prominent challenges include a lack of

adequate technical support for ICT projects, insufficient electricity power supply in schools and the absence of mathematics laboratories equipped with ICT facilities. Collectively, these challenges underscore the hurdles faced by Nigerian Mathematics teachers in their efforts to incorporate ICT into mathematics teaching.

Recommendations

Following the above discoveries, the following recommendations were made that: Mathematics teachers should be encouraged to embrace the new method of teaching (use of ICT) and pursue it with all the zeal it deserves;

1. In-service training, especially on ICT usage in Mathematics teaching be made compulsory for all Mathematics teachers;
2. Seminars and conferences be organized for teachers by experts in the use of ICT in teaching, especially Mathematics teachers;
3. State government should make frantic efforts to provide all the necessary facilities and equipment for the proper ICT usage in teaching Mathematics in secondary schools.

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